

Application for United States Patent

37 C.F.R. § 1.77(b)(1)

Title: APPLIANCE TO CLEAN INDUSTRIAL CHIMNEYS

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FIELD OF THE INVENTION

The invention relates to an appliance to clean industrial chimneys with at least one flue that has a practically horizontal length.

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BACKGROUND

37 C.F.R. § 1.77(b)(5)

At present, industrial chimneys do not always follow a vertical line and usually have horizontal lengths or with a slight slant. This slight slant is necessary for the draft of the fumes.

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Non-vertical lengths of chimneys are normal in chimneys of restaurant and bar kitchens, basically because it is impossible to place vertical piping to the exterior from the location of the kitchen.

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The problem of horizontal or almost horizontal lengths of flues, is cleaning because of their low slant. It should be noted that more dirt accumulates at the start of lesser-slanted flues. This is because these horizontal lengths are slower and therefore dirt tends to remain stuck to the surface of these lengths. A mixture of smoke and grease circulates inside a kitchen chimney and in a horizontal length, the smoke advances owing to the slight slant, but the grease becomes stuck to the walls of this length.

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When cleaning vertical chimneys, the force of gravity plays a significant role, as just by scraping the inside walls of the chimney, the dirt falls downwards. However, it is impossible to clean horizontal lengths in this way.

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Another problem involved in cleaning horizontal lengths of chimneys, which usually consist of lengths of pipe joined by connection flanges, is that high amounts of liquid cleaning products cannot be used, as these would leak out through the pipe connections, spilling onto suspended ceilings and other permeable areas. Cleaning the areas around the pipe connections is also a considerable problem, as perimeter channels on the inner surface of the chimney also lead to grease and dirt settling on the inside.

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SUMMARY OF THE INVENTION

37 C.F.R. § 1.77(b)(6)

5 To solve the aforementioned problems, an appliance has been designed to clean industrial chimneys. The invention provides constructive features aimed at cleaning horizontal lengths or lengths having a slight slant, to ensure that dirt deposited on the inside walls is removed, and to enable the cleaning tasks performed to be observed and recorded.

10 The devise to clean industrial chimneys is especially designed to clean noticeably horizontal lengths of chimney or with a slight slant.

In accordance with the invention, the appliance consists of a cleaning robot provided with caterpillar-type traction devices to move inside the chimney flue to be
15 cleaned, spray devices for cleaning products, scraping devices, suction devices and image capturing devices connected to lighting devices.

According to the invention, the appliance also consists of a suction cleaner connected by means of a pipe to the outlet of the cleaning robot, in order to provide
20 it with the suctioning capacity required to extract the detached dirt from the pipe and any surplus cleaning liquid used; at least one compressor connected by means of a pipe to an inlet of the cleaning robot in order to supply the required cleaning products; and a control box provided with a connection to suitable power supply devices and connected by means of a cable to the cleaning robot, for the purpose
25 of controlling its operation.

The control box enables the operation of the cleaning robot to be controlled by means of the corresponding controls, and therefore all the devices of the robot. This means that the control box can also control the operation of the suction
30 cleaner and the compressor. However, there may be the possibility that the suction cleaner and/or the compressor also have their own control panel in order to control their own operation.

In accordance with the invention, the cleaning robot consists of a body, preferably
35 constructed of aluminium, which has caterpillar-type traction devices on the sides,

and corresponding drive devices inside. The drive devices are controlled through the control box and enable the traction devices to be operated so that the cleaning robot can move forwards, backwards and even turn.

- 5 The spraying devices for cleaning products included in the robot, consist of one or more nozzles anchored to the body of the robot, and which can fan spray degreasants, water or other products from the inlet connected to the compressor.

10 If more than one nozzle is connected, cleaning products can be sprayed simultaneously in several directions. It is also possible that each fixed nozzle sprays one particular product. It may also be possible that if there is more than one nozzle, each can be connected independently to a compressor, or to an individual tank.

- 15 The scraping devices included in the robot consist of a straight brush, made up of flexible, noticeably parallel bristles, which are connected to appropriate turning devices placed inside the body of the robot. These turning devices are operated from the control box. When the turning devices of the straight brush are activated, the centrifugal force produced by the turn, places the flexible bristles in a radial position so that they can scrape inside the chimney flue to be cleaned.

By placing the straight brush in the front part of the cleaning robot, when it is started up, the turn of the flexible bristles in a radial position, traces the circumference of the chimney flue, scraping its interior surface. If the robot also moves longitudinally, the scraping device will cover the entire cylindrical surface of the chimney flue. If the fixed nozzles spray cleaning products on the flexible bristles in a radial position, they will help to disperse the cleaning products properly onto the interior surface of the chimney flue.

- 30 The suction devices included in the robot consist of a cavity connected by a passage to the outlet, where the pipe from the suction cleaner is connected. This cavity forms a suctioning area. The invention includes skirting to cover the side and back areas between the cavity and the lower plane defined by traction devices, in order to delimit a space to optimise the suctioning effect of the suction cleaner.

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The arrangement of the skirting provides an inlet in the front part of the robot, which exactly matches the place where the products scraped from the flue by the brush bristles fall. As suctioning from the suction cleaner is channelled towards this front part, suctioning is very effective.

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The image capturing devices included in the robot comprises mini-cameras that can take and send images to the control box.

One of the mini-cameras is placed in front of the robot and the other behind, in order to take images of the areas of the chimney flue where the robot circulates. The mini-cameras are located inside the body of the robot and preferably the lens is protected by glass.

The lighting devices included in the robot are comprised of light-emitting diodes ("LED"s) or similar elements that provide the necessary lighting for the mini-cameras to correctly capture the images.

It has been planned that the lighting LEDs are positioned around the end of the lens of each of the robot mini-cameras.

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The cleaning robot will also incorporate a base or jack to connect the cable with the control box.

The control box also includes a monitor to view the images taken by the mini-cameras of the robot, either in real time or recorded. Obviously, recorded viewing of these images is possible if the control box includes a recording and storage system of the images taken by the mini-cameras of the robot.

It is possible that the cleaning robot can include additional devices other than those described, or that it does not include all of the devices mentioned.

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Therefore, by using the appliance of this invention, it is possible to clean a horizontal length of chimney or with a certain slant, by inserting the robot inside the flue of the chimney, and moving it by its caterpillar-type traction devices, until it reaches the furthest point of said horizontal length. Once it reaches this position,

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the direction of the robot is reversed so that it returns to the initial position. During the return, the compressor is activated so that the fixed nozzles spray degreasant onto the surface of the chimney flue. After this return operation, the robot is sent back to the furthest point of the flue, and when it returns, the fixed nozzles spray
5 very highly pressured water, the straight brush is started-up, the flexible bristles scrape the inside surface of the flue and the suction cleaner suctions through the corresponding cavity of the robot.

Viewing the images taken by the mini-cameras inside the chimney, in real time,
10 enables more or less intensive cleaning of the different lengths, depending on the dirt accumulated, and also enables the condition of the chimney to be viewed before and after cleaning.

BRIEF DESCRIPTION OF THE DRAWINGS

15 37 C.F.R. § 1.77(b)(7)

- Figure 1 shows a diagram drawing of the appliance for cleaning industrial chimneys in the operational position inside a chimney.
- Figure 2 shows a perspective view of the cleaning robot.
- Figure 3 shows a back elevation view of the cleaning robot, without any
20 connections.
- Figure 4 shows a side elevation cross view of the robot, where the suction cavity can be observed together with the skirtings that delimit it sideways and at the back.

DETAILED DESCRIPTION OF THE INVENTION

37 C.F.R. § 1.77(b)(8)

As can be observed in Fig. 1, the appliance to clean industrial chimneys is comprised of a cleaning robot (1), a suction cleaner (2), a compressor (3) and a control box (4). Its purpose is to clean lengths that are formed by a noticeably horizontal or slightly slanted flue (5).

As shown in Figs. 2 to 4, the cleaning robot (1) comprises caterpillar-type traction devices (7), a fixed nozzle (8), connected to an inlet (9), a straight brush (10), a suction cavity (11), joined by a passage (12) to an outlet (13), skirtings (14), mini-cameras (15), LEDs, (16) and a base or connection jack (17).

The caterpillar-type traction devices (7) enable the cleaning robot (1) to move inside the chimney flue (5) to be cleaned, as indicated in Fig. 1. The drives that move these traction devices (7), which may be gears or other drive devices understood by those skilled in the locomotive art, are located inside the body (6). The tracks may be constructed of the different materials known by those skilled in the art.

The suction cleaner (2) is connected by a pipe (18) to the outlet (13) of the cleaning robot (1) and provides the required suctioning capacity so that suctioning takes place in the cavity (11) to collect the dirt deposited in this area of the flue (5). Skirtings (14) placed in the side and back areas of the cavity (11) help to optimise the suctioning capacity of the suction cleaner (2), as they prevent the suctioning from dispersing and concentrate it in one specific area. In Fig. 4, the suctioning devices of the cleaning robot (1) can be observed.

The compressor (3) is connected by a pipe (19) to the inlet (9) of the cleaning robot (1) and is connected to the fixed nozzle (8). In this way it is possible to feed the fixed nozzle (8) with the required cleaning products, which can be degreasants, water or other products. At the same time, the fixed nozzle (8) fan sprays the cleaning products onto the inside surface of the flue (5).

As shown in Fig. 4, the straight brush (10) consists of flexible bristles (20) placed noticeably parallel. When the straight brush (10) is started-up by means of rotating

devices located inside the body (6), the centrifugal force makes the flexible bristles (20) be placed in a radial position, as indicated in the diagram of Fig. 1. This radial position of the bristles (20) enables them to scrape the inside of the chimney flue (5).

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The mini-cameras (15) can take and send images from the cleaning robot (1) to the control box (4). In order to take these images, suitable lighting is necessary inside the flue (5). The LEDs (16), located around the lenses of the mini-cameras (15) as indicated in Figs. 2 and 3, provide this lighting.

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In the system described, the cleaning robot (1) has a mini-camera (15) and LEDs (16) at the front, as shown in Fig. 2, and an identical lay-out at the back of the robot (1) as shown in Fig. 3.

15 The control box (4) has a connection (21) to receive the corresponding power supply and by operating the corresponding controls, operates all the elements of the appliance. At the same time, the control box (4) is connected by a cable (22) to the base or connection jack (17) of the cleaning robot (1), which is where the connections are made to the various devices incorporated in the cleaning robot (1).

20 In this way, it is possible to control from the control box (4), the spraying of products through the fixed nozzles (8), the rotation of the straight brush (10), the traction devices (7), to activate the lighting devices (16) and the front and back mini-cameras (15),

25 Apart from the corresponding controls to control the described appliance, the control box (4) also has a monitor (23) to view the images taken by the mini-cameras (15). Viewing can be in real time or recorded, as the control box (4) includes image-recording devices.

30 The following table lists the part numbers and part descriptions as used herein and in the drawings attached hereto.

Parts List

<u>Part Number:</u>	<u>Description:</u>
1	Cleaning robot
2	Suction cleaner
3	Compressor
4	Control box
5	Chimney flue
6	Body
7	Traction device
7a	Rear sprocket
7b	Front sprocket
7c	Upper sprocket
8	Nozzle
9	Inlet
10	Straight brush
11	Cavity
12	Passage
13	Outlet
14	Skirting
15	Mini-camera
16	LEDs
17	Base
18	Suction cleaner pipe
19	Compressor pipe
20	Flexible bristles
21	Control box connection
22	Control box cable
23	Monitor

Having sufficiently described the nature of the invention, together with an example of a preferred embodiment, it is hereby stated that the materials, form, size and layout of the elements described, may be modified as long as this does not alter the essential features or spirit of the invention, the claims for which are given below.